

## The arrojadite enigma: II. Compositional space, new members, and nomenclature of the group

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### ABSTRACT

A systematic chemical and structural investigation of arrojadite-group minerals has provided new data allowing us to design a consistent nomenclature scheme, approved by the IMA CNMMN (vote 05-D). The cornerstones of this scheme are: (1) the fundamental structural formula for the arrojadite group is  $A_2 B_2 Ca Na_{2+x} M_{13} Al (PO_4)_{11} (PO_3OH_{1-x}) W_2$ , where A are either large divalent cations (Ba, Sr, Pb) plus vacancy, or monovalent (K, Na) cations, B are either small divalent cations (Fe, Mn, Mg) plus vacancy, or monovalent (Na) cations. (2) The dominant cation at the M sites defines the root-name: Fe<sup>2+</sup>, arrojadite; Mn<sup>2+</sup>, dickinsonite; Mg (if any), name to be proposed. (3) Two suffixes are added to the root-name according to the dominant cation of the dominant valence state at the A1 and B1 sites (the mono- or divalent nature of the cation used implicitly specifies the dominant occupancy by Na or the dominant vacancy, respectively, at the A2 and B2 sites, according to two heterovalent substitutions). (4) A third suffix is added in case the sum of non-(P,Al) cations exceeds 20.5 apfu [which implies that the Na3 site is more than half occupied and the total (OH,F) content is less than 2.5 apfu]. (5) Prefixes may be added to the root-name in the case of dominance of F over OH at the W site or of Fe<sup>3+</sup> over Al at the Al site.

The compositional range explored is quite large, with either K, Sr, Ba, or Pb as the dominant cation at A1; Na, Fe, or Mn dominant at B1; Na or vacancies dominant at A2 and B2; Na or vacancy at the Na3 site; and F or OH at the W site. Lithium can amount up to 1 Li pfu and is partitioned into the M sites, preferentially M1. As a consequence of this new nomenclature scheme, the mineral name “sigismundite” is abolished and the corresponding composition must be referred to as arrojadite-(BaFe). In addition, arrojadites–dickinsonites from classic localities are identified as arrojadite-(KFe) (Nickel Plate Mine), dickinsonite-(KMnNa) (Branchville), fluorarrojadite-(BaFe) (Sidi-bou-Kricha), and we define the new members arrojadite-(KNa) (Rapid Creek), arrojadite-(PbFe) (Sapucaia), and arrojadite-(SrFe) (Horrsjöberg).

**Keywords:** Crystal structure, arrojadite, analysis, chemical (mineral), new minerals, arrojadite-(PbFe), fluorarrojadite-(BaFe), arrojadite-(BaFe), optical properties, XRD data